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FURTHER STUDIES ON JELUTONG.[1]

By V. R. Greenstreet.

THE production of jelutong in the F.M.S. has increased from only 100 pikuls[2] in 1922 to over to 2,000 pikuls in 1923, while during the latter year a total of 50,000 pikuls with a value of nearly a million dollars passed through Singapore. Nearly all this was shipped to the U.S.A. where it is in growing demand as a cheap substitute for West Indian chicle in the manufacture of chewing gum. The bulk of the jelutong of commerce is derived from Sarawak and the Netherland Indies where however owing to crude methods of preparation and lack of transport facilities, wastage due to deterioration is enormous. It is confidently asserted by the Singapore representative of an important New York firm of jelutong dealers that it would be easily possible for British Malaya, by using standardised methods of preparation and by virtue of its efficient transport system, to capture the whole of this trade.

Methods of Preparation.

The customary coagulants for jelutong latex are kerosine oil, alum, sulphuric acid or methylated spirits. The physical condition of the coagulum depends upon whether it is pressed into a compact block or left to dry in the unpressed state. Unpressed coagulum although spongy is brittle and when fresh or preserved in water can retain up to 70 per cent. of moisture within its cells. On drying, such coagulum retains its honeycomb structure, but eventually falls to dust, in which condition it is resistant to wetting, exhibits none of the plastic properties of jelutong and is of no commercial value. The presence of kerosine oil prevents excessive loss of moisture. Although the effect of pressing the coagulum is to squeeze out a large amount of water, a certain proportion is retained very tenaciously to give a product which although brittle, exhibits when masticated with warm water, all the plastic properties of jelutong. Coagulation with kerosine oil has always been popular because the retention of so much water by the coagulum resulted in bigger profits. On the other hand, owing to the difficulty in eliminating the taste of kerosine from the finished chewing gum, many efforts have been directed towards discovering a method whereby a similar effect could be produced without the accompanying objectionable taste. This has led to the fabrication of innumerable "obat"[3] of secret formulae for treating crude unpressed jelutong

1. Jelutong. Eaton, B. J. & Dennett, J. H., Malayan Agricultural Journal, 1923, XI, 220.

2. Pikul = 133 pounds.

3. "obat": medicine (also applied to any mixture of chemicals)

coagulated with sulphuric acid or alum. The two principal constituents of those "obat" which the author has analysed are castor oil and ammonia, while each jelutong "refiner" adds a complicated mixture of incompatible chemicals having no scientific basis. After boiling with "obat" the jelutong is pressed into blocks and stored in water until a few days before packing. Jelutong prepared in this manner is put on the market as a "refined jelutong." In this connection it may be remarked that the density of "refined jelutong" is so little greater than unity that it has the interesting property of floating in hot water and sinking in cold water. Owing to the diversity in the composition of "obat," "refined jelutong" is a very variable product. Some brands are tasteless but in other respects very similar to that resulting from kerosine oil coagulation, while others soon dry to a useless and permanently crumbly powder. For this reason added to the fact that freight charges are thereby increased, "refined jelutong" is falling into disfavour. A high moisture content is moreover being discounted by dealers who now pay on a moisture free basis.

Experimental.—Samples of jelutong latex were coagulated using various coagulants, the results being recorded in Table I.

TABLE I.

No.	Name of coagulant.	Amount of coagulant. Parts per 1,000.	Time of coagulation. Days.	Description of hand pressed coagulum.
1	Anaerobic -	...	3	hard: slight foul odour: good colour.
2	Aerobic -	...	3	hard: slight foul odour: good colour.
3	Sodium silicofluoride.	10	1	hard: no odour: very good colour.
4	Ammonia-alum -	30	1	hard: no odour: good colour.
5	Acetic acid -	1	1	hard: slight odour: good colour.
6	Sulphuric acid -	0.5	½	hard: no odour: good colour.
7	Sugar -	10	2	hard: slight foul odour: good colour.
8	Tannic acid -	5	2½	hard: no odour: dark colour.
9	Sugar and tannic acid.	10+5	2	hard: slight foul odour: good colour.
10	Kerosine oil -	25	1½	soft: odour of kerosine oil: fairly good colour.
11	Castor oil -	25	3	soft: odour of castor oil: fairly good colour.

Although the first nine coagula were hard and brittle, none deteriorated to a crumbly powder, and when masticated with warm water regained their plasticity. The satisfactory physical condition

of a coagula Nos. 10 and 11 was discounted by their odour. From general considerations coagulation with sodium silicofluoride and sulphuric acid yielded the most satisfactory results.

General Characteristics and Defects.

As a result of the examination of jeulutong prepared by the principal methods of coagulation and "refining", followed up by a discussion with manufacturers representatives, attention was focussed on the general defects to which jelutong is liable and which must be guarded against in the preparation of a standard product. These defects may be considered under the headings:—

1. Rate of drying.
2. Resinification.
3. Mould development.

Rate of drying.—As deterioration due to crumbling to a permanent powder appeared to be due to excessive auto-desiccation, it was decided to compare the rate of drying of samples prepared by direct coagulation, with that of "refined jelutong." Seven samples of jelutong were accordingly exposed to the drying action of an electric fan at room temperature for 1 month and weighed daily: a description of the samples is appended in Table II while the accompanying curve shows the diminution in moisture content due to evaporation.

Table II.

Description of jelutong samples examined for moisture retaining properties.

Sample No.	Treatment.	Keeping Qualities.
1	"Refined"	... good
2	"Refined"	... inferior
3	"Refined"	... bad
4	Coagulated with sodium silicofluoride: pressed	... good
5	Coagulated with sulphuric acid: pressed	... good
6	Coagulated with kerosine oil: pressed	... good
7	Coagulated with alum: unpressed	... bad

The curves show that one sample of "refined jelutong" (No. 2) has a water-retaining capacity comparable to that of kerosine oil coagulated jelutong (No. 6). Another sample of refined jelutong (No. 3) looses moisture at approximately the same rate as that directly coagulated with sulphuric acid (No. 5): deterioration set in however in sample No. 3 and not in sample No. 5. The sample coagulated with sodium silicofluoride (No. 4) dried still

further and yet showed no signs of deterioration, while in the unpressed sample coagulated with alum (No. 7) extreme desiccation is accompanied by deterioration. With a minimum moisture content of 5 per cent therefore, deterioration is not a function of desiccation, although a good moisture retaining capacity appears to be some criterion of satisfactory keeping properties.

Resinification.—Deterioration of jelutong is characterised by entire loss of cohesion and elasticity, while that of (unvulcanised) *Hevea* rubber is characterised by excessive tackiness. It has been shown however that the ultimate condition of deteriorated *Hevea* rubber is hard smooth and dry[4]. This phenomenon is marked by an increase in resin and oxygen content and occurs particularly under the catalytic influence of copper. Jelutong resign has been studied by Alexander[5] who found that its analysis corresponded to C_{25} $H_{40}O$. He regarded this as an oxidation product of caoutchouc having the constitution $(C_{10}H_{16})_5O_2$. Such being the case, the addition of 4.7 per cent. oxygen on its caoutchouc content (approximately 20-25 per cent.) that is one per cent. of oxygen on the total jelutong should be sufficient to resinify the whole of the caoutchouc fraction. It has been demonstrated however that in the case of *Hevea* rubber, susceptibility of the caoutchouc to oxidation varies inversely with the resin content[6]. This would lead us to expect jelutong caoutchouc to be particularly resistant to oxidation. Experiments were however carried out to test this hypothesis and discover :—

(a) if the results for the determination of moisture by drying to constant weight at 100°C in a current of air, and under reduced pressure are comparable.

(b) if the proportion of resin increases on drying at 100°C.

(c) how the proportion of resin changes with deterioration, and

(d) the effect of prolonged heating in a current of air and under reduced pressure on (1) the weight, and
(2) the resin content.

Throughout these experiments the numbering adopted in table II was adhered to, while resin was determined by acetone extraction and recorded as a percentage on the dry weight.

TABLE III.

Moisture content of duplicate samples of jelutong dried at 100°C.

Method of drying.	Moisture per cent.
In a current of air ...	35.5
Under reduced pressure ...	35.55

4. Whitby G. S. Plantation rubber and the testing of rubber, 1920.

5. Gummi-Zeitung, 1904. 18. 867.

6. Peachy. Society of Chemical Industry Journal, 1912. 31. 1103. Kirchof. Kolloid Zeitschrift, 1913. 13. 49.

As identical results for loss of moisture are obtained by these two methods, subsequent resin estimations are comparable.

TABLE IV.

Resin content of duplicate samples of jelutong dried in different ways.

Treatment.	Resin per cent.
Extracted wet ...	79.4
Dried at 100°C under reduced pressure..	79.2
Dried at 100°C in a current of air ...	79.8

As drying has no appreciable affect on the resin content, the following tables giving the resin content of jelutong dried in different ways are comparable.

TABLE V.

Resin content of samples of jelutong which remained undeteriorated after 6 months.

Sample No,	Resin per cent.
1. ...	79.1
4. ...	78.4
5. ...	76.5
6. ...	79.2

TABLE VI.

Resin content of samples of jelutong which underwent natural deterioration.

Sample No.	Resin per cent on fresh sample.	Resin per cent on deteriorated sample.
2.	80.6	80.5
3.	77.0	82.6
7.	82.0	82.6

These figures show that jelutong normally contains from 76 per cent to 82 per cent of resin. A normal resin content however is no criterion of quality although an abnormally high resin content is indicative of deterioration.

TABLE VII.

Changes in weight and resin content due to prolonged heating at 100°C.

No.	Treatment.	Change in weight per cent.	Resin per cent.
1.	Crepe heated in a current of air for 1 month ...	- 0.1	92.4
2.	Block heated in current of air for 1 month ...	+ 0.35	90.5
2.	Block heated in a current of air for 1 week ...	- 1.7	79.8
3.	Crepe heated in a current of air for 1 week ...	+ 0.75	94.9
3.	Block heated in a current of air for 1 week ...	- 7.8	98.5
3.	Block heated under reduced pressure for 1 week ...	- 4.8	97.6

These figures show that the action of heat on jelutong is to increase its resin content and that it is possible by sufficiently prolonged heating to convert nearly all the caoutchouc fraction into resin.

Moreover, resinification occurs equally whether the sample is heated in a current of air or under reduced pressure. It is inconclusive therefore whether resinification is due to oxidation of the caoutchouc, although the increase in weight which occurs in two cases favours the oxidation hypothesis. In one case a sample when heated in a current of air lost weight for three weeks before beginning to increase. In another case a sample which had gained 0.4 per cent in weight after heating for one month was transferred to a flask with a reflux air condenser. This was heated on the steam bath and yielded an amorphous sublimate and a crystaline sublimate, while drops of an acid liquid condensed in the reflux tube. The change in weight during heating is therefore the resultant of an increase (due probably to oxidation) and a decrease due to the escape of moisture and other volatile constituents: so that resinification of jelutong even if primarily due to oxidation of the caoutchouc to resin is accompanied by complicated secondary reactions. Resinified jelutong is very sticky when hot and very brittle when cold, in which respects it resembles naturally deteriorated jelutong. It was decided that a complete investigation of the oxidation process was too lengthy to be essayed at present. Under these circumstances no analyses of the resin itself were undertaken. It was noted however that the resin of good undried jelutong was white and hard even when hot while that extracted from deteriorated jelutong was viscous when hot and brown in colour. The degree of colour of the resin varied with the extent to which the jelutong had previously been heated. This seems to indicate that—as is the case with *Hevea* rubber—resin resulting from the oxidation of the caoutchouc is different from the resin originally present.

Mould development.—Although moist *Hevea* rubber is highly susceptible to mould growth, jelutong rubber is far less so. Except

for transient slight exterior discolorations, the only cases in which any degree of mould development have been found are :—

1. Crude unpressed coagulum stored in a cool, dark place.

2. Commercial samples of " refined jelutong."

The former case is of negligible commercial importance since the conditions were abnormal. In the latter case however mould growth occured under normal circumstances, i.e. when a block was cut in half and exposed to the air.

As susceptibility of rubber to mouldiness is considered to be related to protein content, estimations of nitrogen were carried out on several samples and the results tabulated in table VIII.

TABLE VIII.

Proportion of nitrogen and protein in various samples of jelutong (calculated on the dry material)

	Nitrogen per cent.	Equivalent to protein. per cent.
Jelutong latex	0.112	0.70
Fresh wet coagulam	0.084	0.53
" Refined jelutong "	0.112	0.70

These figures show that although the proportion of nitrogen is very small, the bulk of it is associated with the coagulum. Treatment with " obat " causes a small increase in nitrogen content due to addition of ammonia. In order to determine suitable mould preventitives, blocks of " refined jelutong " were prepared with the addition of various antiseptics according to table IX.

TABLE IX.

Proportion of various antiseptics added to " refined jelutong."

No.	Antiseptic added.	Quantity on wet weight of jelutong. per cent.
1	Formalin	0.14
2	Formalin	0.20
3	Phenol	0.04
4	Beta-naphthol	0.04
5	Mixed phenols	0.04
6	Sodium bisulphite	0.04

Each block was cut in half : one half was placed under an electric fan and the other half maintained moist by the daily addition

of water. After one month, samples No. 1, 2 and 3 both wet and dry showed signs of mould while samples No. 4, 5 and 6 were free from mould. The actual exterior of the blocks was far less susceptible to mould than the interior. This was probably due partly to the presence of a very dry skin which formed and partly to removal of soluble food materials by the prolonged immersion in water. In all cases of mouldiness the effects were purely superficial and the interior of the blocks were in no way affected. Samples of mouldy jelutong were examined by the Mycologist who reported on them as follows :—

"Surface discolorations appear on prepared jelutong blocks. "These discolorations are caused by fungi though little pro- "gress is made compared with the rate of progress of fungus "discolorations on ordinary rubber. It would appear that jelu- "tong is not so good a medium for fungus growth as the rubber "from *Hevea brasiliensis*. The commonest discolorations noted "have been black, yellow and red. Only in the first does the "fungus progress to any extent. Two fungi have been found "associated with the black discolorations; one a species of "*Phoma*, which does not appear to be closely associated with the "blackening of the jelutong, the other a *Brachysoperium* type of "fungus which produces short four-celled dark coloured spores; "this fungus seems capable of slowly penetrating the jelutong "blocks. No definite association of a fungus with the yellow or "red spots has been observed. In most discoloured pieces taken "from jelutong blocks, the black discoloration is present along "with either the yellow or red. When small pieces are taken "placed on damp blotting paper in petri-dishes the usual course "is for a profuse development of *Penicillium* and *Eurotium* Spp., "which eventually disappear. The red and yellow spots are still "noticable even after the disappearance of the above mentioned "fungi, but they gradually fade out, and the fungus causing the "black discoloration is the only one to remain. This fungus "appears to be strongly resistant to desiccation and makes "progress in apparently well dried pieces of jelutong".

Summary.

I. Conditions in the F M.S. appear to be favourable for meeting the growing demand for Jelutong.

II. Various methods of coagulation and "refining" are described and commented on.

III. The characteristics and defects of jelutong prepared in various ways are emumerated and dealt with under the headings :—

1. Rate of drying.
2. Resinification.
3. Mould development.

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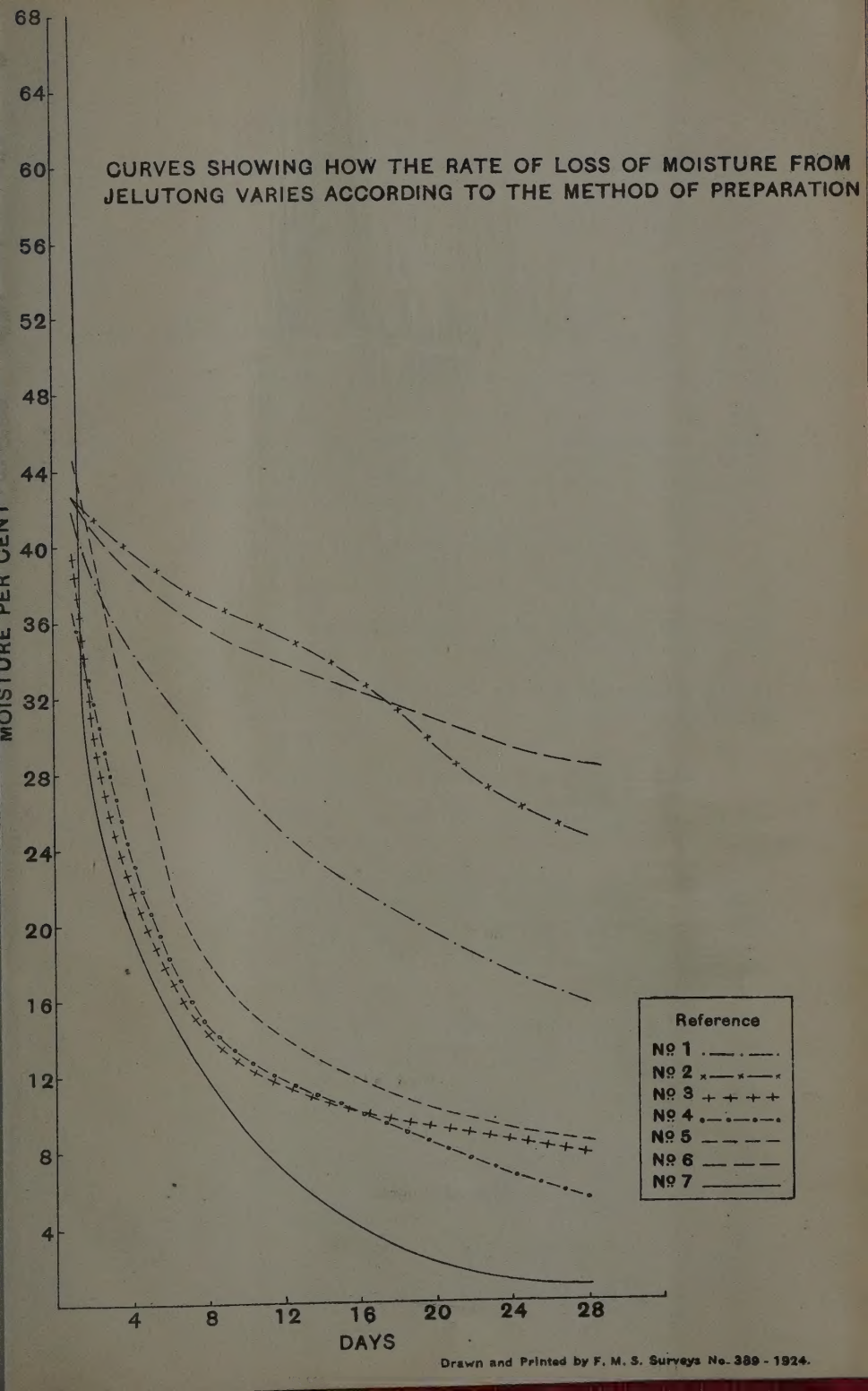
CURVES SHOWING HOW THE RATE OF LOSS OF MOISTURE FROM JELUTONG VARIES ACCORDING TO THE METHOD OF PREPARATION
MOISTURE PER CENT
68
64
60
56
52
48
44
40
36
32
28
24
20
16
12
8
4
4
8
12
16
20
24
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DAYS
Reference
No 1
No 2
No 3
No 4
No 5
No 6
No 7
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TWO NEW APPLICATIONS OF RUBBER.

By B. J. Eaton.

I.—Rubber Stop-Butts.

An interesting and useful application of raw rubber has been discovered by Mr. W. Towgood, late of Kuala Selangor.

This consists in the application of raw rubber as stop-butts for rifle shooting.

This application of rubber has received an enthusiastic reception from the Society of Miniature Rifle Clubs in Great Britain, as the following advertisement in "The Rifleman," the official organ of this Association, will indicate.

"Advantages of crepe Rubber used on Stop-Butts.

(1) Saves cost of target boards.

(2) Prevents composition of butts being disturbed or distributed which usually happens when boards are shot away.

(3) Prevents bullet splashing thus avoiding:—(a) Danger to surroundings. (b) Damage to lamps. (c) Splash holes on targets.

(4) Captures all shots fired into Bullet-catchers.

(5) Saves the lead, which can be sold and thus benefits rifle club funds.

The reason of all the above advantages is that a great number of shots may pass through the rubber without removing any portion thereof and it solidifies immediately. (Note:—The hole made by the bullet in passing through the sheet of crepe rubber closes up immediately after the bullet passes through. B. J. E.)

Sheets of crepe rubber, measuring 20 inches by 13 inches by $\frac{1}{3}$ inch thick, suitable for dividing into two parts for two targets (either 25 or 50 yards match cards) or the complete piece may be used for 100 yard match cards, are advertised by the Society in "The Rifleman."

The following is an abstract of articles on the subject which have appeared in "The Rifleman" November, 1923 Volume XX No. 161, December, 1924, Volume XX No. 162 and February, 1924 Volume XX No. 164.

Tests carried out have proved so satisfactory that it is considered that the material will be a prime factor in the construction of stop-butts and will minimise the danger of bullet splinters.

(Note :—The usual protection for 0.22 bullets at short ranges is a ¼ inch steel plate fixed at an angle of 45°, with the centre opposite the centre of the target to deflect the bullets downwards into a trough lined with stout sheet iron filled with saw dust.)

The stop butts proposed are as follows :—The stop butt box is 12 inches deep 16 inches wide and 17 inches long. The front of the box, to which the target is attached, consists of a piece of the rubber sheet described. The box is divided vertically into two parts by means of a wooden partition to which a similar sheet of rubber is attached. The partition is placed at 10 inches from the front. The distance between the partition and the rear of the box is 6 inches and in the rear space is placed the steel plate at an angle of 45°. The front part of the box between the two rubber sheets is filled with sawdust.

The bullets just penetrate the partition of wood and rubber and drop in the space in front of the steel plate.

Since the holes made by the bullets in the rubber sheets close up immediately, the sawdust is retained in the front part of the box and the clean bullets can be collected periodically from the empty space in the rear portion of the boxes.

In the case of 15 and 20 yard ranges, the front part of the box must be larger, to contain an extra thickness of sawdust, and for 50 and 100 yard ranges may be smaller.

The box is placed at the necessary height on a stand in front of the stop-butt or on brackets attached to the butts.

The size given above (17 inches in length, 16 inches width, 12 inches depth) is suitable for one or two targets. In the case of two or more targets a continuous box, on the same principle, may be cheaper. For outdoor ranges, the tops of the boxes can be covered with a loose sheet of iron to keep out rain.

The writer, through the courtesy of Mr. Towgood, has had the opportunity of seeing a piece of rubber used as a target-board for six months at the Wimbledon Park Rifle Club. Several thousand shots had been fired through the cardboard targets backed with this piece of crepe rubber and the rubber only shows dark spots at the places penetrated. Mr. Towgood obtained this piece of rubber for exhibition on the R. G. A. Stall in the Malaya Pavilion at the British Empire Exhibition.

The most important application is undoubtedly the lining of boxes used as stop-butts. Holes can be cut in the wooden boxes or most of the front and back of the boxes can be cut away. If these

rubber lined boxes are filled with sand, for stopping the bullets, the constant renewal of the boxes is avoided and the sand has not to be continually replaced in new wooden boxes which are splintered rapidly by the bullets. The application is recommended to the attention of our Rifle Clubs in Malaya.

Blue print copies of bullet catchers can be obtained from the Secretary, Society of Miniature Rifle Clubs, Strand, London at 1/-.

II.—Fibrok.

A Fibrous Rubber Product for Footwear.

One of the most useful products exhibited in the Agricultural Section of the Malayan Pavilion at the British Empire Exhibition was Fibrok, a fabric composed of a fibrous material impregnated with latex and used for welting, insoling and middling soles of boots and shoes.

The application of this material should increase and encourage the use of the crepe sole, which has already gained considerable popularity in Great Britain.

As is well known, the crepe sole cannot be attached easily to the leather insole or welt of footwear, while if stitched to the leather, the stitches are liable to cut through the crepe sole. The usual method of attachment at present adopted is to stitch a thin layer of smooth crepe to the leather insole and then to attach by solution, a separate piece of crepe, which is rough or corrugated on one surface and smooth on the other side, to the smooth layer of crepe which is stitched to the leather.

In the application of Fibrok, this product can be stitched securely to the leather insole and a crepe sole can then be attached securely, by suitable solutions, to the Fibrok, which forms the "middle" sole of the boot or shoe. The product can also be used instead of leather to form the insole of footwear.

Methods of attachment:—Three solutions, the exact composition of which is not known, but which appear to consist of emulsions made from latex preserved with ammonia and benzene or other suitable rubber solvents, are prepared by Fibrok Products Limited.

For direct adhesion of Fibrok and canvas, for canvas footwear, two solutions (A and C) are employed, solution A being applied to the canvas and solution C to the Fibrok. The treated surfaces are then pressed, rolled or hammered together.

For adhesion between Fibrok and leather the leather is damped and combed with a wire brush and then coated with solution C and the two materials rolled and hammered together.

For adhesion between Fibrok and crepe or between two layers of Fibrok or two layers of crepe, the surfaces are coated with Fibrok C. and then pressed, rolled or hammered together.

Boots and shoes in which Fibrok was used, made by a number of manufacturers, were exhibited in the Malaya Pavilion and attracted considerable attention.

Sheets of Fibrok material in white, brown or grey colours, measuring 64 inches × 26 inches approximately, are prepared by the firm. Samples and further particulars of the product and solutions can be obtained from Fibrok Products Limited. 10 Fenchurch Avenue, London, E.C.-3.

During a visit to the Leather Trades' Exhibition in London the writer also found that a somewhat similar material known as Bateman's Fibrous Crepe was being exhibited by Bateman's Factory, West Harrow, Middlesex.

It was not possible to judge the respective merits of the two products.

The latter firm also stock crepe sole edge stains, black, white and brown, for colouring the edges of crepe soles, in order to match the colour of the uppers. The objection to the manufacture on the estate of coloured crepes for attachment to uppers of similar colour is that inferior crepes may be used, since the application of dyes or colouring matters is liable to obscure defects in the raw rubber. The production of stains to colour the edges, after the crepe soles are attached to the footwear, meets this objection and also supplies the demands of buyers who do not like the natural colour of the crepe sole, when attached to brown or black uppers.

REPORT ON THE WEEKLY FAIRS IN KRIAN.

By Mohamed Noor.

IN certain villages in Krian and in Larut Districts a fair is held once a week, mainly for the sale of produce, grown or obtained locally, among the inhabitants of the villages. A few travelling salesmen or hawkers visit each fair in turn bringing cloth, or agricultural implements and materials proper to the season.

The following report by the Acting Agricultural Inspector Perak North, Inche Mohd. Noor, gives interesting details of these fairs and shows that they successfully serve a useful purpose in supplying local needs and providing a local market for all kinds of local produce brought to the market in comparatively small quantities and sold there by the producers themselves. It is hoped that the existence of these local markets will lead to an increased production of food stuffs and fruit around the villages where they are held. For this reason especially it is hoped that similar fairs can be started in villages in most other parts of the country. F.W.S.]

Weekly fairs in Krian have, I understand, been in existence in places for several years. On enquiry the present District Officer informed me that they were started long before he came to Krian; those at Simpang Tiga (Kuala Kurau), Gunong Semangol and Titi Serong were started in 1919 ? or 1920.

At present a weekly fair is held at:

(1)	Sungei Gedong	...	on Sunday
(2)	Bukit Merah	...	Monday
(3)	Changkat Lobak, Gunong Semangol and Simpang Tiga (K. Kurau)	...	Tuesday
(4)	Jalan Bahru & Simpang Ampat (Selinsing)	...	Wednesday
(5)	Mesjid Tinggi and Titi Serong	...	Thursday
(6)	Alor Pongsu	...	Saturday.

There is no fair on Friday. Of the ten villages mentioned above, I was only able to visit Sungei Gedong, Bukit Merah and Alor Pongsu on December 23rd, 24th and 25th, 1923.

Each fair generally begins at about six or seven o'clock in the morning and finishes just before or about noon.

There are no stalls or temporary sheds erected for this purpose, all goods being spread out upon ordinary mats, gunny bags and newspapers by the side of the public road or on vacant land close to the village. Kampong people of both sexes are to be seen coming in from

various directions, each carrying a basket or two of whatever goods he or she has for sale.

On arrival the arrangement of articles for sale commences. At the same time the cloth-dealers as well as the toy-sellers are busy with their heavy bundles of cloth and of playthings. Very soon the place is filled with people of various ages and business then begins. Almost every one makes his or her purchases. Between 10 and 12 o'clock the crowd gradually disperses, thus ends the fair.

Movers to the next fair are mostly the cloth-dealers, toy-sellers, book and medicine sellers and the Chinese vegetable sellers.

The following are the principal articles displayed for sale :--

(i) Under the heading of agricultural crops, no cereals, such as padi, rice, pulut rice and maize were seen in any of the fairs I recently visited, the main reason being, I think, that the people store only sufficient padi for their own consumption, the surplus being sold to millers during harvest. Whether it is on sale or not after the next padi harvest remains to be seen. Raw maize is not at present in the market, but a small quantity of it in the form of cake was seen at Sungei Gedong and Alor Pongsu.

(ii) A fair amount of vegetables, such as carrots, yams, eggfruit (brinjals), sweet and Bengal potatoes, cucumber and ladies' fingers are always to be found and are sold by Chinese, the villagers usually bring out chillies and cow-peas (*Vigna ca'jang*), or a few "mentimun bendang."[1]

No vegetable from the jungle are brought to any of the fairs.

(iii) I did not see any fruits other than a few common varieties of banana or plantain, jack-fruits (*Artocarpus Polyphemia*) and durians. The last two were brought from Larut District by Malays because better prices were expected in Krian

Other local fruits are not in season.

(iv) Coming to the crops of economic importance one can readily get tapioca, coconuts, sireh and split betel nut, Pinang Blah, sold by Banjarese and Javanese women. *Zalacca Conferta*, Assam Kelubi, and *Garcinia atroviridis*, Assam Gelugor, can also be had occasionally.

(v) Java tobacco, "Roko" made of Nipah shoots, all sorts of cigarettes and cigars and matches are sold by Malays and Chinese who come from Bagan Serai and Kuala Kurau.

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1. A kind of pumpkin grown on the banks dividing the rice fields.

(vi) Under the fish and poultry section, a fair amount of fresh and salted river or bendang[2] fish was quickly sold by Banjarese. Salt-fish from Bagan Serai or Kuala Kurau is always brought and sold by Chinese at a reasonable price. For unknown reasons domestic fowls were not in evidence, and, I understand, are not usually brought to the market. Hen and duck eggs can be obtained every week. A fairly large number of ducklings were easily disposed of at Alor Pongsu.

(vii) Spices and oils—all kinds of spices can be obtained at any of the fairs.

It is regrettable to see that no coconut oil nor soap is on sale.

Vinegar extracted from the Nipah palm can be procured at a reasonable price at the Sunday fair either in Krian at Sungei Gedong, or in Larut at Simpang Tiga, Changkat Jering.

(viii) Amongst the food-stalls there stood one or two stalls of Malay books (Kitabs, Korans and Hikayats), and of native-prepared medicines and medicinal plants sold by Malays and people from Penang. The business is not very flourishing owing, I am told, to the supply of free medicines to the villagers by the Government once in two weeks.

(ix) Only in exceptional cases are mats and dish covers, Tudong Saji, to be found on sale, but, if required, they can be bought at Sungei Gedong and Alor Pongsu at a fair price.

"Belachan",[3] the Malayan cheese, can be found everywhere in quantity. It is made at Kuala Kurau and is brought to the fair and sold by the Malays of that village.

(x) At every fair there are many cloth-dealers who take up their stand all in a group, each being separated from his neighbour by the beautifully coloured sarong batak[4] that are hung for sale on bamboos or sticks supported by four small wooden posts, with a "kajang"[5] forming the roof. The trade is mostly run by Punjabese who undoubtedly make a fair profit. Different kinds and qualities of cloth that look very attractive at their price are nicely spread out upon the mat. The attention of the passers-by is soon attracted by the various patterns and

2. Bendang = rice field.

3. Belachan = a paste of prawns and small fish used as a relish for curry.

4. Sarong Batak = Cloth for Malay skirts made by the Batak tribe in Sumatra.

5. Kajang = a waterproof matting made of leaves.

colours of the cloth and by the honeyed words of the tradesmen.

Adjoining these there are a few toy-stalls also run by Punjabese. A large quantity of assorted cheap toys and life-like dolls are offered for sale. The latter are anxiously waiting to be acquired by the passing girls whose repeated cries and pleading usually cause their fathers and mothers to purchase the dolls.

(xi) In another corner usually at the end of the fair Banjarese as well as Javanese women are busily selling all sorts and shapes of cakes and of sweets either prepared at home quite early in the morning, or made on the spot. People, old and young, are invited to partake of this "kueh" in return for a few cents when the purchaser has satisfied his hunger.

Judging from what I have seen at the three places visited I am perfectly certain that weekly fairs in Krian have been a success. Those at Changkat Jering and Batu Kurau also show improvement. It is hoped that each and every district in the F.M.S. will have similar fairs.

The most crowded and successful fair is that at Sungei Gedong the next being at Alor Pongsu.

It is a pity that the people of all the villages at which fairs are held do not attempt to grow vegetables and other food-stuffs regularly in their kampongs, as the Chinese always do. Things can be remedied if every encouragement is given both by the Agricultural Department and the District Officers. I was able to talk on this matter with only one Penghulu in Krian who seemed to agree to what I said, and who told me that he is trying his utmost to make the fair in his mukim more successful than it is at present.

The prices of all the goods sold are fair. It is certainly a dull day for the village shop-keepers, as their usual customers are not anxious to visit them. Things are only bought in the shops if not obtainable in the fair.

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LIST OF ECONOMIC PLANTS, CULTIVATED AT THE EXPERIMENTAL PLANTATION, SERDANG, SELANGOR, 1925.*

By J. N. Milsum.

Ag Agriculturist, F.M.S. & S.S.

THE object of this article is to provide in tabular form a list of the plants established on the 1st January, 1925 at the Experimental Plantation, Serdang. It is considered that it will be of assistance to visitors to the Plantation, who will thus be able to retain a permanent record of the various plants seen. The list will also be useful for general reference.

The scientific names are those adopted in the 'Index Kewensis.' The majority of the Malay names are taken from the list compiled by Ridley and Curtis, published in the journal of the Straits Branch, Royal Asiatic Society, July 1902.

I.—Food Crops.

Latin Name.	Natural Order.	English Name.	Malay Name.
Arenga saccharifera -	Palmae	Sugar Palm	Kabong
Cajanus indicus -	Leguminosae	Pigeon Pea	Kachang Kayu
Coix Lacryma-jobi -	Gramineae	Job's Tears	Jelai Batu
Dioscorea alata -	Dioscoreaceae	Greater Yam	Ubi Nasi, U. Merah, U. junjong
,, esculenta -	,,	Lesser Yam	Kemili or Kombili
Eleusine coracana -	Gramineae	Ragi	Sambau
Glycine hispida -	Leguminosae	Soya Bean	Kachang Japun
Ipomoea Batatas -	Convolvulaceae	Sweet Potato	Ubi Keledek
Manihot utilissima -	Euphorbiaceae	Tapioca	Ubi Kayu
Maranta arundinacea -	Marantaceae	Arrowroot	
Metroxylon Sagu -	Palmae	Sago	Rembia
Oryza sativa -	Gramineae	Rice	Padi
Pennisetum typhoideum -	,,	Bulrush Millet	
Phaseolus lunatus -	Leguminosae	Lima Bean	Kachang China
Saccharum officinarum -	Gramineae	Sugar Cane	Tebu
Sorghum vulgare -	,,	Sorghum	Betari
Vigna Catjang -	Leguminosae	Cow Pea	Kachang Panjang
Voandzeia subterranea -	,,	Bambarra Ground Nut	,, Manila
Zea Mays -	Gramineae	Maize	Jagong

* Reprinted as Circular No. 1/25.

II.– Fruits.

Latin Name.	Natural Order.	English Name.	Malay Name.
Ananas sativus	Bromeliaceae	Pineapple	Nanas
Bertholletia excelsa	Myrtaceae	Brazil Nut	
Bouea macrophylla	Anacardiaceae	...	Kundangan
Canarium commune	Burseraceae	Java Almond	Kenari
,, Kadondon	,,	...	Kedondong Matahari.
,, ovatum	,,	Pili Nut	
Carica Papaya	Passifloreae	Papaya	Betek
Chrysobalanus icaco	Rosaceae	Coco Plum	
Citrus acida	Rutaceae	Lime	Limau Kapas
,, Limonum	,,	Lemon	,, Chumbol
Cynometra cauliflora	Leguminosae	Nam-nam	
Diospyros discolor	Ebenaceae	Butter Fruit	Buah Mentega Buah Sakahlat
Eugenia brasiliensis	Myrtaceae	Brazil Cherry	
Mimusops elengi	Sapotaceae	...	Bunga Tanjong
Morus indica	Urticaceae	Indian Mulberry	
Musa spp.	Scitamineae	Banana	Pisang
Tamarindus indica	Leguminosae	Tamarind	Asam Jawa
Terminalia Catappa	Combretaceae	Indian Almond	Ketapang

III.–Beverages.

Camellia Thea	Ternstroemiaceae	Tea	Cha (doun)
Coffea spp.	Rubiaceae	Coffee	Kopie
Theobroma Cacao	Sterculiaceae	Cocoa	

IV.—Fixed Oils and Fats.

Aleurites Fordii	Euphorbiaceae	Tung Oil	
,, montana	,,		
,, triloba	,,	Candle Nut	Buah Keras
Arachis hypogaea	Leguminosae	Ground Nut	Kachang Goreng
Bassia latifolia	Sapotaceae	Ilippai Nut	
Butyrospermum Parkii	,,	Shea Butter	
Elaeis guineensis	Palmae	African Oil Palm	
Elateriospermum Tapos	Euphorbiaceae	...	Prah
Isoptera borneensis	Dipterocarpeae	Borneo Tallow	Tengkawang
Ricinus communis	Euphorbiaceae	Castor Oil	Jarak
Sesamum indicum	Pedaliaceae	Gingelly	Lenga

V.—Essential Oils.

Acacia farnesiana	Leguminosae	Cassie	Lasane
Canangium odoratum	Anonaceae	Cananga	Kenanga
Citrus Aurantium var. Bergamia.	Rutaceae	Bergamot Oil	

V.—Essential Oils.—*contd.*

Latin Name.	Natural Order.	English Name.	Malay Name.
Cymbopogon citratus -	Gramineae	Lemon Grass	Minyak Serai Wangi.
,, Nardus -	,,	Citronella Grass	Minyak Serai
,, Martini -	,,	Geranium oil Grass Palmarosa oil Grass	
Dryobalanops aromatica -	Dipterocarpaceae	Borneo Camphor	Kapur Barus
Pogostemon Cablin -	Labiatae	Patchouli	
,, Heyneanus -	,,	,,	Nilam
Vetiveria zizanioides -	Gramineae	Vetiver Grass	Akar Usar-usar

VI.—Fibre Plants.

Abroma augusta -	Sterculiaceae		
Agave sisalana -	Amaryllidaceae	Sisal Hemp	
Boehmeria nivea -	Urticaceae	Ramie Fibre	Ramin
Bromelia argentina -	Bromeliaceae	Caraguata Fibre	
,, Balansae -	,,		
,, Magdalenae -	,,	Pita Fibre	
Corchorus capsularis -	Tiliaceae	Round-podded Jute	
,, olitorius -	,,	Long-podded Jute	
Crotalaria juncea -	Leguminosae	Sunn Hemp	
Eriodendron anfractuosum	Malvaceae	Kapok	Kabu-kabu, Kerkabu.
Furcraea cubensis -	Amaryllidaceae		
,, gigantea -	,,	Mauritius Hemp	
Gossypium barbadense -	Malvaceae	Long-staple Cotton	Kapas
,, brasiliense -	,,	Kidney Cotton	Kapas
Hibiscus cannabinus -	,,	Bimlipatam Jute	
,, Sabdariffa var. altissima.	,,	Roselle Fibre	
Musa textilis -	Musaceae	Manila Hemp	Pisang hutan
Sansevieria trifasciata. -	Haemodoraceae	Bowstring Hemp	
,, metallica -	,,		

VII.—Drugs.

Chenopodium ambrosioides var. anthelminticum -	Chenopodiaceae	Chenopodium oil plant	
Cola acuminata -	Sterculiaceae	Kola Nut	
Croton Tiglium -	Euphorbiaceae	Croton Oil	Chengkian
Erythroxylon Coca -	Linaceae	Cocaine-Plant	
Hydnocarpus anthelminthicus -	Bixaceae	Chaulmoogra Oil	
Hydnocarpus Wightiana -	,,		
Jatropha Curcas -	Euphorbiaceae	Purging Nut	Jarak Blanda
Psychotria Ipecacuanha -	Rubiaceae	Ipecacuanha	
Teraktogenos Kurzii -	Bixaceae	(Burmese) Chalmoogra or Kalaw	

VIII.—Spices.

Latin Name.	Natural Order.	English Name.	Malay Name.
Cinnamomum zeylanicum	Lauraceae	Cinnamon	Kayu Manis
Eugenia caryophyllata	Myrtaceae	Clove	Chengkel
Myristica fragrans	Myristicaceae	Nutmeg	Pala
Piper nigrum	Piperaceae	Pepper	Lada Hitam
Vanilla planifolia	Orchidaceae	Vanilla	

IX.—Dyestuffs & Tanning Materials.

Bixa Orellana	Bixaceae	Annatto	Kesumba
Indigofera Anil	Leguminosae	Indigo	Nila
,, arrecta	,,	Java-Natal Indigo	
Uncaria Gambier	Rubiaceae	Gambier	Gambir

X.—Fodder Grasses.

Andropogon halepensis	Gramineae	Johnston Grass	
,, sorghum sudanensis	,,	Sudan Grass	
Axonopus compressus	,,	Carpet Grass	
Chloris Gayana	,,	Rhodes Grass	
Coelorrachis glandulosa	,,		Terapoh, Tebu Salak
Cynodon Dactylon	,,	Bermuda Grass	
Digitaria didactyla	,,	Australian Blue Couch	
,, eriantha	,,		
Mellinis minutiflora var. mutica	,,	Molasses Grass	
Panicum laevifolium	,,		
,, maximum	,,	Guinea Grass	
,, muticum	,,	Mauritius Grass	
Paspalum dilatatum	,,	Dallis Grass	
Pennisetum purpureum	,,	Napier Grass	
,, ,, var	,,	Merker Grass	
Sorghum versicolor	,,		
Tricholaena rosea	,,	Natal Red-Top Grass	
Urochlea brachyura	,,		
Zoysia pungens	,,		

XI.—Fodder Crops.

Desmodium tortuosum	Leguminosae		
Prosopis juliflora	,,	Algaroba Bean	
Stizolobium Deeringiana	,,	Velvet Bean	Kachang Balanga

XII.—Cover Crops.

Latin Name.	Natural Order.	English Name.	Malay Name.
Calopogonium mucunioides	Leguminosae		
Canavalia ensiformis -	,,	Sword Bean	Kachang Parang
,, turgida -	,,		,, Hantu
Cassia hirsuta -	,,		Sinteng
,, mimosoides -	,,		
,, occidentalis -	,,		Kachang Kota
Centrosema Plumieri -	,,	Butterfly Pea	
,, pubescens -	,,		
Clitoria cajanifolia -	,,		Beluntas Padi
Crotalaria anagyroides -	,,		
,, incana -	,,		
,, maijussai -	,,		
,, striata -	,,		
,, usaramoensis -	,,		
Desmodium gyroides -	,,		
Dolichos biflorus -	,,	Horse Gram	
Leucaena glauca -	,,		Petai Jawa
Mikania scandens -	Compositae		Akar Lupang
Mimosa invisa -	Leguminosae	Giant Mimosa	
Sesbania aculeata -	,,		
,, sericea -	,,		
Tephrosia candida -	,,		
,, Hookeriana var. amoena -	,,		
,, purpurea -	,,		
,, Vogelii -	,,		
Vigna marina -	,,		
,, oligosperma -	,,	Sarawak Bean	

XIII.—Shade Trees.

Adenanthera pavonina -	Leguminosae		Saga besar
Calophyllum inophyilum -	Guttiferae		Penaga Laut
Erythrina indica -	Leguminosae	Dadap	Dedap
Gliricidia maculata -	,,		
Jacaranda ovalifolia -	Bignoniaceae		
Peltophorum ferrugineum -	Leguminosae		
Pithecolobium dulce -	,,	Madras Thorn	
,, Saman -	,,	Rain Tree	

XIV.—Miscellaneous Products.

Areca Catechu -	Palmae	Areca Nut	Pinang
Derris elliptica -	Leguminosae	Tuba Root	Tuba
Dialium laurinum -	,,		Karanji Papan
Entada scandens -	,,		Akar Sintok
Hymenaea Courbaril -	,,	West Indian Gum Tree.	
Nicotiana rustica -	Solanaceae	Tobacco	} Temakan
,, Tabacum -	,,	,,	
Palaquium Gutta -	Sapotaceae	Gutta-percha	Getah Taban Merah
,, obovatum -	,,		,, ,, Putch
Zingiber officinale -	Scitamineae	Ginger	Halliya

LONDON MARKET PRICE LIST, 4th QUARTER 1924.

Oil Seeds.

Castor (Bombay)	-	£31.15.0 per ton.
Copra (Ceylon)	-	£32. 5.0 ,, ,,
Do. (Straits)	-	£31. 2.6 ,, ,,
Cotton (Egyptian)	-	£13.17.6 ,, ,,
Do. (Bombay)	-	£11.17.6 ,, ,,
Croton		27/6—32/6 per cwt.
Desiccated Coconut (fine)	-	42/6 ,, ,,
Do. Do. (medium)	-	42/6 ,, ,,
Do. Do. (coarse)	-	45/- ,, ,,
Gingelly (Chinese)	-	£29.15.0 per ton.
Groundnuts (Gambia, undecorticated)	-	£20.15.0 ,, ,,
Do. (Chinese, decorticated)	-	£25.10.0 ,, ,,
Linseed (Bombay)	-	£24.10 0 ,, ,,
Do. (Plate)	-	£22. 5.0 ,, ,,
Palm Kernels (West Africa)	-	£22.15.0 ,, ,,

Oils.

Castor (Madras)	-	70/- per cwt.
Do. (Pharmaceutical)	-	80/- ,, ,,
Do. (1st pressing)	-	75/- ,, ,,
Do. (2nd pressing)	-	73/- ,, ,,
Coconut (Cochin)	-	60/ ,, ,,
Do. (Ceylon)	-	47/6 ,, ,,
Cotton seed (Egyptian, crude)	-	43/- ,, ,,
Do. (Bombay)	-	41/- ,, ,,
Groundnut (Oriental, crude)	-	52/- ,, ,,
Do. (English)	-	51/6 ,, ,,
Linseed (Calcutta)	-	44/6 ,, ,,
Do. (Plate)	-	43/6 ,, ,,
Palm (Lagos)	-	£42.10.0 per ton.
Do. (Sumatra)	-	£36. 2.6 ,, ,,
Palm kernel	-	45/- per cwt.

Oil Cakes.

Coconut	-	£12.12.6 per ton.
Cotton (Egyptian seed)	-	£ 8.15—£ 9.2.6 per ton.
Do. (Bombay seed)	-	£ 8.10— ,, ,, ,,
Groundnut (decorticated)	-	£13. 5—£13.10 ,, ,,
Linseed	-	£13.12.6 ,, ,,
Palm kernel	-	£ 8.10.0 ,, ,,

Essential Oils.

Cajeput	-	3/2 per lb.
Camphor (Chinese, crude)	-	2/4½ ,, ,,
Do. (Japanese, refined)	-	2/8 —2/9 ,, ,,
Camphor (oil)	-	60/- per cwt.

ential Oils.—*contd.*

Cinnamon (Ceylon leaf)	-	6/8—7/4 per lb.
Citronella (Ceylon)	-	3/1 „ „
Do. (Java)	-	5/8 „ „
Clove	-	7/3—7/6 „ „
Lemon grass (Cochin)	-	4/3 „ „
Lime (West Indian, expressed)	-	10/- „ „
Do. (do. distilled)	-	6/- „ „
Patchouli (Penang)	-	14/6—18/- per lb. (according to quality)
Do. (Mysore)	-	18/- „ „
Vetiver (Bourbon)	-	50/- „ „

Spices.

Capsicums (East Indian)	-	40/—45/- per cwt.
Do. (Nyassaland)	-	60/—70/- „ „
Chillies (Zanzibar)	-	35/—40/- „ „
Do. (Nyassaland)	-	50/—60/- „ „
Do. (Japan)	-	149/- „ „
Cinnamon (Ceylon)	-	1/4—1/7 per lb.
Cloves (Zanzibar)	-	1/—1/1 „ „
Do. (Penang)	-	2/6—3/- „ „
Ginger (Japan)	-	92/- per cwt.
Do. (Jamaica)	-	140/—170/- „ „
Mace (Bombay and Penang)	-	2/6—3/2 per lb.
Nutmegs (Singapore and Penang)		
110's	-	2/2 „ „
80's	-	2/5 „ „
64's—57's	-	2/5—2/6 „ „
Pepper (Singapore, black)	-	5d. „ „
Do. (do. white)	-	9d. „ „
Turmeric (Bengal)	-	80/- per cwt.

Drugs.

Cinchona Bark	-	According to Analysis.
Cocaine (hydrochloride)	-	24/- per oz.
Ipecacuanha (Rio)	-	7/6—8/- per lb.

Natural Dyestuffs and Extracts.

Annatto (seed)	-	10d.—1/- per lb.
Gambier (block)	-	70/- per cwt.
Do. (cubes)	-	120/- „ „

Gums and Resins.

Damar Singapore)	-	30/—150/- per cwt.
Do. (Batavia)	-	120/—160/- „ „
Dragon's blood (reeds)	-	£18—£25 „ „
Do. (lump)	-	£11—£38 „ „
Guttapercha (genuine)	-	2/9—6/- per lb.
Do. (Sarawak)	-	3/—4/- „ „
Do. (Siak, reboiled)	-	9d. „ „
Jelutong	-	£30—£60 per ton.

Fibres.

Cotton (American G.O. to Mid.)	-	12.04d.—13.69d. per lb.
Do. (Egyptian, Sakellaridis, G. F. to fine)	-	25.10d.—27.30d. „ „
Hemp (Manila, "J" grade)	-	£56 per ton.
Do. (Mauritius)	-	£45.10—£48 „ „
Do. (New Zealand)	-	£42.10—£44.10 „ „
Do. (Sisal)	-	£27—£53 „ „
Kapok (Indian)	-	10½d. per lb.
Do. (Java)	-	1/1—1/2 „ „

Foodstuffs.

Cocoa (Ceylon, plantation)	-	80/—115/- per cwt. (in bond)
Coffee (Malay, plantation)	-	100/-—130/- per cwt. (in bond)
Do. (Malay, Liberian)	-	100/-—111/- per cwt. (in bond)
Sago (pearl)	-	28/- per cwt.
Do. (flour)	-	17/6—18/6 „ „
Sugar (Java, white)	-	20/1½ „ „ „ (excluding duty)
Tapioca (Penang, flake)	-	3½d.—4d. per lb.
Do. (Penang, flour)	-	18/-—22/- per cwt.

Chemicals.

Acetic acid (glacial)	-	£68.10 per ton.
Do. (80% comml.)	-	£43. „ „
Acetone	-	£93—£94 „ „
Ammonia (.880)	-	£22 „ „
Calcium acetate (grey)	-	£14 „ „
Citric Acid	-	1/3½ per lb.
Formalin (40% vol.)	-	£49 per ton.
Lime Juice (concentrated)	-	£18.15 per basis. *
Sodium bisulphite (60—62%)	-	£17—£18 per ton.
Sodium sulphite (anhydrous)	-	£27.10 „ „
Wood Creosote (unrefined)	-	2/9 per gallon.

* Basis = 108 gallons, 64 ozs. of Citric Acid per gallon.

Publications of the Department of Agriculture.

The following publications, except those out of print, may be obtained on application to the Office of the Secretary for Agriculture; and the Malay States Information Agency, 88, Cannon Street, E.C. London.

A remittance to cover the cost should accompany applications; otherwise the Journals will be sent by post, Cash on Delivery, where that system is in force.

1. The Agricultural Bulletin F.M.S.

Vols. I—IV (1913-16) VIII & IX (1920-21)		price $5.00 per volume.	
Vol. V	(1917) Nos. 1, 2, 3, 5 & 6	,,	2.50 per set.
,, VI	(1918) ,, 1, 7, 8 & 12	,,	2.00 ,,
,, VII	(1919) ,, 2—6	,,	4.50 ,,

2. The Malayan Agricultural Journal (continuing the Agricultural Bulletin). Published monthly.

Vol. X (1922) Price $5.00 per volume.
,, XI (1923) Price $5.00 per volume or 50 cents per single number.

Back numbers of Vols. I—X will not be sold singly.

3. The Handbook of Malayan Agriculture, price $1.00.

Current numbers of the Malayan Agricultural Journal and the Handbook may be purchased at the Railway Bookstalls and Branches of Messrs. The Federal Rubber Stamp Co.

4. *Special Bulletins.*

1. Notes on *Termes Gestroi* and other species of Termites found on Rubber Estates in the Federated Malay States, by H. C. Pratt, Government Entomologist, 1909, 20 cts.
2. Root Diseases of *Hevea Brasiliensis*, by W. J. Gallagher. C
3. Observations on *Termes Gestroi* as affecting the Para Rubber Tree and methods to be employed against its Ravages, by H. C. Pratt, Government Entomologist, 1910, reprint 1916, 20 cts.
4. A Lepidopterous Pest of Coconuts, *Brachartona catoxantha, Hamps*, by H. C. Pratt, 1909. C
5. The Extermination of Rats in Rice Fields, by W. J. Gallagher, 1909. C
6. Preliminary note on a Branch and Stem Disease of *Hevea Brasilienisis*, by W. J. Gallagher, 1909. C
7. Coffea Robusta, by W. J. Gallagher, Government Mycologist, 1910, 20 cts.
8. The Cultivation and Care of the Para Rubber Tree (in Malay) 1910. C
9. Die-Back Fungus of Para Rubber and of Cacao, by K. Bancroft, 1911. C
10. A Lecture on the Para Rubber Tree, by W. J. Gallagher, 1910. C
11. Coconut Cultivation, by L. C. Brown, 1911. C
12. Padi Cultivation in Krian, by H. C. Pratt, 1911. C
13. A Root Disease of Para Rubber, *Fomes Semitostus*, by K. Bancroft, Assistant Mycologist, 1912, 20 cts.

C = Cancelled

14. The Die-Back Disease of Para Rubber and a note on the Leaf Diseases of Para Rubber, by K. Bancroft, 1911. C

15. Camphor : its Cultivation and Preparation in the Federated Malay States, by B. J. Eaton, Agricultural Chemist, 1912, 20 cts.

16. The Spotting of Plantation Para Rubber (A Preliminary Account of Investigations on the cause of the Spotting), by K. Bancroft, Mycologist, 1913, 20 cts.

17. The Preparation of Plantation Para Rubber, by B. J. Eaton, 1912. C

18. Agriculture in Malaya, 1912, by L. Lewton Brain, 1914. C

19. The Spotting of Prepared Plantation Rubber, by A Sharples, Assistant Mycologist, 1914, 20 cts.

20. Agriculture in Malaya, in 1913, by L. Lewton Brain, 1914. C

21. Pink Disease, by F. T. Brooks, Mycologist, and A. Sharples, Assistant Mycologist, 1915, 20 cts.

22. A Disease of Plantation Rubber caused by *Ustulina Zonata*, by F. T. Brooks, 1915. C

23. The Tapping of the Para Rubber Tree, by E. Bateson, Assistant Mycologist, 1914, 20 cts.

24. The Malayan Locust, by H. C. Pratt, Government Entomologist, and F. de la Mare Norris, Assistant Agricultural Inspector, 1915, 20 cts.

25. *Ustulina Zona'a*—a Fungus affecting *Hevea Brasiliensis*, by A. Sharples, Mycologist, 1916, 20 cts.

26. Vegetable Culture in Malaya, by F. G. Spring, Agriculturist and J. N. Milsum Superintendent Government Plantations, 1917. Second Edition 1919, 50 cts.

27. The Preparation and Vulcanisation of Plantation Para Rubber, by B. J. Eaton, Agricultural Chemist, J. Grantham and F. W. F. Day, Assistant Agricultural Chemists, 1918, $1.00.

28. A Wet Rot of Para Rubber, by W. N. C. Belgrave, Assistant Mycologist, 1919, 50 cts. (Out of print).

29. Fruit Culture in Malaya, by J. N. Milsum, Superintendent Government Plantations, 1919, $1.00. (Out of print).

30. Food Production in Malaya, by F. G. Spring, Agriculturist, and J. N. Milsum, Acting Assistant Agriculturist, F.M.S., 1919, $1.00.

31. Black Stripe and Mouldy Rot of *Hevea Brasliensis*, by A. Sharples, W. N. C. Belgrave, F. de la Mare Norris and A. G. G. Ellis, $1.00. (Out of print).

32. Observations on the Technique required in Field Experiments with Rice, by H. W. Jack, $1.00.

33. Wet Padi Planting in Negri Sembilan, by D. H. Grist, $1.00.

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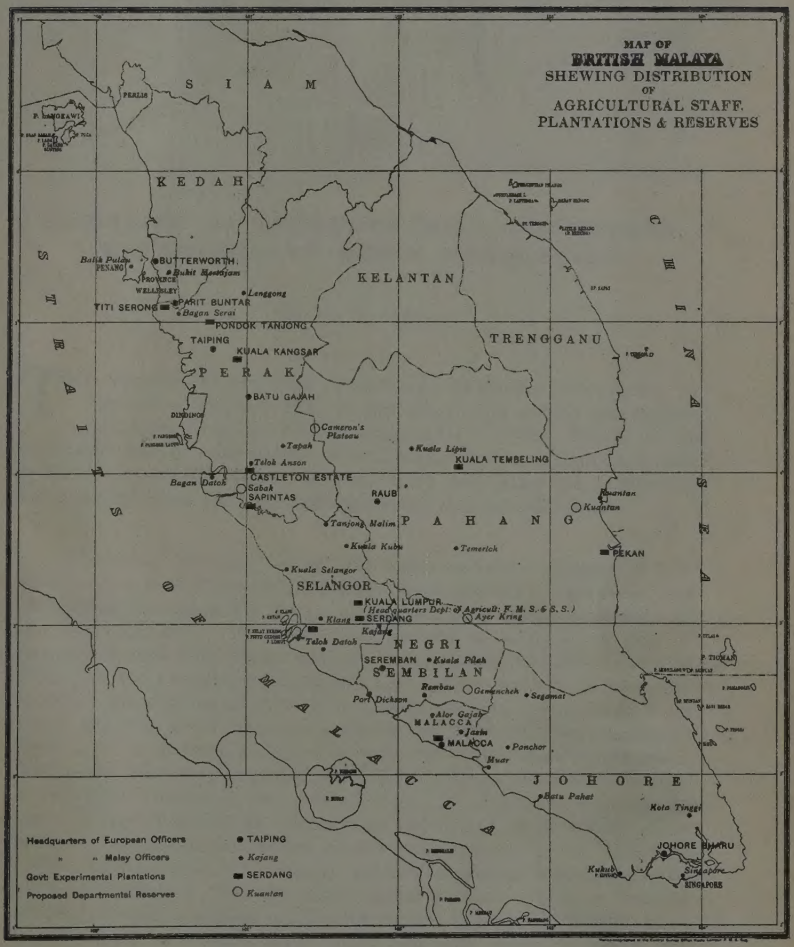
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